

CLAIMS

We claim:

1. A controller module unit, comprising:

- 5 a printed circuit board having an upper surface;
a plurality of controller module connectors of a first type mounted on the
printed circuit board, each controller module first type connector
comprising:
 an elongated body;
10 a plurality of first type connector elements arranged generally in
alignment with the length of the elongated body;
 a flexible latching detent attached to the elongated body;
a controller module, comprising:
 a controller module housing having a top wall, a bottom wall and a pair
15 of opposing elongated side walls and a pair or opposing shorter
side walls, and a module connector element of a second type
extending from the bottom wall,
 the module housing second type connector comprising:
 an elongated second type connector body having a plurality
20 of second type connector elements arranged generally in
alignment with the length of the elongated connector body;
 an elongated generally rigid latching member extending along
one side of the elongated second type connector body;
a controller module alignment and positioning frame mounted on the printed
25 circuit board;
the controller module positioning and alignment frame comprising:
 a front wall and a rear wall, each having an interior surface
 a connector bay containing a respective one of the controller module
first type connectors;
30 a first and a second guide shelf extending generally parallel to the
upper surface of the printed circuit board, the separation of each of
the first and second guide shelves from each other defining a first
dimension of the connector bay;
 at least one guide wall extending vertically upward from each of the
35 first and second guide shelves, the position of the at least one guide
wall defining a second dimension of the connector bay for the

- respective module first type connector;
- wherein the first and second guide shelves are positioned with respect to the respective connector bay and the respective first type connector element is positioned with respect to the connector bay and the second type connector element is positioned with respect to the bottom wall of the module housing such that when a first one of the pair of shorter walls of the module housing is in contact with the interior surface of one of the front and rear walls of the positioning and alignment frame, the module housing second type connector body comes into contact with one of the first and second shelves and when the second one of the pair of shorter walls of the module housing is in contact with the interior surface of the other of the front and rear walls of the positioning and alignment frame, the module housing second type connector body enters into the respective connector bay and enables connection between the first and second type connector elements.
- 15 2. The apparatus of claim 1 wherein when the first of the pair of shorter walls is in contact with the interior surface of the other of the front and rear walls of the positioning and alignment frame, the body of the module second type connector is prevented from entering the respective receptor bay by engaging the body of the module second type connector.
- 20 3. The apparatus of claim 1 in which the first type connector is a male type connector having a plurality of pins and the second type connector is a female connector having a plurality of pin receptacles.
- 25 4. The apparatus of claim 1 in which the second type connector is a male type connector having a plurality of pins and the first type connector is a female connector having a plurality of pin receptacles.
- 30 5. The apparatus of claim 2 in which the first type connector is a male type connector having a plurality of pins and the second type connector is a female connector having a plurality of pin receptacles.
- 35 6. The apparatus of claim 2 in which the second type connector is a male type connector having a plurality of pins and the first type connector is a female connector having a plurality of pin receptacles.

7. The apparatus of claim 1 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of second type connector elements are aligned displaced from the centerline.

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8. The apparatus of claim 2 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of female connector receptacles are aligned displaced from the centerline.

10 9. The apparatus of claim 3 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of male connector pins are aligned displaced from the centerline.

15 10. The apparatus of claim 4 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of second type connector elements are aligned displaced from the centerline.

11. The apparatus of claim 5 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of female connector receptacles are aligned displaced from the centerline.

20 12. The apparatus of claim 6 wherein the bottom wall of the controller module housing has a centerline along its length and the plurality of male connector pins are aligned displaced from the centerline.

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13. The apparatus of claim 3 wherein the flexible latching detent comprises:
a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.

30 14. The apparatus of claim 4 wherein the flexible latching detent comprises:
a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.

15. The apparatus of claim 5 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
16. The apparatus of claim 6 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
17. The apparatus of claim 7 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
20. 18. The apparatus of claim 8 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
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19. The apparatus of claim 9 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
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20. The apparatus of claim 10 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
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21. The apparatus of claim 11 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a
 - 5 lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
22. The apparatus of claim 12 wherein the flexible latching detent comprises:
 - a generally vertical wall having an upper end and a lower end, with an upper slanted detent surface protruding from one side of the generally vertical wall and a
 - 10 lower slanted detent surface protruding from the same side of the generally vertical wall and intersecting the upper slanted surface.
23. A controller module unit, comprising:
 - a printed circuit board having an upper surface;
 - 15 a plurality of controller module connectors of a first type mounted on the printed circuit board, each controller module first type connector comprising:
 - an elongated body;
 - 20 a plurality of first type connector elements arranged generally in alignment with the length of the elongated body;
 - a latching means attached to the elongated body;
 - a controller module, comprising:
 - 25 a controller module housing having a controller module connector element of a second type extending from the controller module housing,
 - the controller module second type connector comprising:
 - 30 an elongated second type connector body having a plurality of second type connector elements arranged generally in alignment with the length of the elongated connector body;
 - a latching means for, in cooperation with the latching means on the controller module first type connector, holding the controller module first type connector and second type connector in a mated position;
 - a controller module alignment and positioning means mounted on the
 - 35 printed circuit board;
 - the controller module positioning and alignment means comprising:

- a connector bay containing a respective one of the controller module first type connectors;
- 5 guide means for positioning the controller module second type connector element with respect to the controller module first type connector element, including a guide shelf and at least one guide wall extending vertically upward from the guide shelf, for preventing the second type connector element from entering the receptor bay unless the first type connector element and the second type connector element are properly aligned and positioned to engage in the mated position.
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23. The apparatus of claim 22 wherein first type connector element and the second type connector element are positioned with respect to the controller module housing and the receptor bay so as to prevent entry of the controller module second type connector element into the receptor bay if the first type connector element and second type connector element are not properly aligned and positioned to ally the first type connector element and the second type connector element to engage in the mated position.
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24. The apparatus of claim 22 in which the first type connector is a male type connector having a plurality of pins and the second type connector is a female connector having a plurality of pin receptacles.
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25. The apparatus of claim 22 in which the second type connector is a male type connector having a plurality of pins and the first type connector is a female connector having a plurality of pin receptacles.
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30. The apparatus of claim 23 in which the first type connector is a male type connector having a plurality of pins and the second type connector is a female connector having a plurality of pin receptacles.
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27. The apparatus of claim 23 in which the second type connector is a male type connector having a plurality of pins and the first type connector is a female connector having a plurality of pin receptacles.
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27. The apparatus of claim 22 wherein the controller module housing has a

- centerline along its length and the plurality of second type connector elements are aligned displaced from the centerline.
29. The apparatus of claim 23 wherein the controller module housing has a
5 centerline along its length and the plurality of female connector receptacles are aligned displaced from the centerline.
30. The apparatus of claim 24 wherein the controller module housing has a
10 centerline along its length and the plurality of male connector pins are aligned displaced from the centerline.
31. The apparatus of claim 25 wherein controller module housing has a centerline along its length and the plurality of second type connector elements are aligned displaced from the centerline.
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32. The apparatus of claim 26 wherein the controller module housing has a centerline along its length and the plurality of female connector receptacles are aligned displaced from the centerline.
- 20 33. The apparatus of claim 27 wherein the controller module housing has a centerline along its length and the plurality of male connector pins are aligned displaced from the centerline.
34. The apparatus of claim 24 wherein the controller module first type connector
25 latching means comprises:
a generally vertical flexible wall with a detent means contained on the generally vertical wall.
35. The apparatus of claim 25 wherein the controller module first type connector
30 latching means comprises:
a generally vertical flexible wall with a detent means contained on the generally vertical wall.
36. The apparatus of claim 26 wherein the controller module first type connector
35 latching means comprises:
a generally vertical flexible wall with a detent means contained on the

generally vertical wall.

37. The apparatus of claim 27 wherein the controller module first type connector latching means comprises:

- 5 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

38. The apparatus of claim 28 wherein the controller module first type connector latching means comprises:

- 10 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

39. The apparatus of claim 29 wherein the controller module first type connector latching means comprises:

- 15 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

40. The apparatus of claim 30 wherein the controller module first type connector latching means comprises:

- 20 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

41. The apparatus of claim 21 wherein the controller module first type connector latching means comprises:

- 25 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

42. The apparatus of claim 22 wherein the controller module first type connector latching means comprises:

- 30 a generally vertical flexible wall with a detent means contained on the generally vertical wall.

43. The apparatus of claim 23 wherein the controller module first type connector latching means comprises:

- 35 a generally vertical flexible wall with a detent means contained on the generally vertical wall.